Paragraph

Xerography

1▶ One more familiar use of electrochemistry that has made its way into the mainstream is xerography, a process for replicating documents that is dependent on photoconductive materials. A photoconductive material is an insulator in the dark but becomes a conductor when exposed to bright light. When a photocopy is being made, an image of a document is projected onto the surface of a rotating drum, and bright light causes the photoconductive material on the surface of the drum to become conductive.

2▶ As a result of the conductivity, the drum loses its charge in the lighted areas, and toner (small grains to which dry ink adheres) attaches itself only to the darker parts of the image. The grains are then carried to a sheet of paper and fused with heat. When a laser printer is used, the image is projected by means of a laser beam, which creates a brighter light and a greater contrast between lighter and darker areas and therefore results in sharper printed images.

3▶ Xerography has gone through a series of innovations since its invention in the late 1930s by Chester Carlson. One of the most notable alterations was to the name of the process. When Carlson first developed the technique, he called it "electrophotography" since it used both photography and electrostatic printing in the procedure. Later the name was changed to "xerography" in recognition of the fact that the process reproduces documents without the use of liquid chemicals, instead using a powdered toner to replicate the images.

4▶ A more significant change was made to the instruments that actually created the copies. Initially, the procedure took several steps to complete, and necessitated the use of flat plates that were manipulated by hand through the various copying stages. From the beginning, Carlson and others involved with the process realized how inconvenient and time-consuming it was to make a copy, and they worked continuously on ideas to make the process faster and more efficient. Eighteen years after the original machine was introduced to the public, they devised a suitable solution to the flat plates: a cylindrical rotating surface that allowed the process to be entirely automatic, except for a push of the "start" button.

5▶ The revolutionary invention of the rotating drum meant the copier was now viable as a commercial product. The first commercial automatic copier, the Xerox 914, came onto the market in 1960. This first generation of copiers was cumbersome by today's standards; not many households would be able to dedicate the necessary space it would take to have one of these early machines. Fortunately, continuing innovations in both the xerographic process and other types of technology have greatly decreased the size of machines capable of making copies. Today, the vast majority of copy machines, as well as many laser and LED printers, make use of Carlson's ingenious idea.

6▶ Photocopying through xerography involves several steps. First, an electrostatic charge is evenly spread over the surface of the rotating drum, or cylinder. The distributed charge is positive or negative depending on what type of copy is being made and what type of copier is being used. Standard copiers generally distribute a positive charge, while digital copiers use a negative charge. Next, the document being duplicated is exposed to light by flash lamps. At the same time, a combination of lenses and mirrors projects the original image through a lens, so that it is projected onto and synchronized with the rotating drum.

7▶ The third and fourth steps of the process concern the development and transfer of the image. In the development stage, a form of static electricity propels toner powder to coat the image that was projected onto the drum in the previous step. Then, in the transfer step, the toner from the drum, now in the form of the image, is transferred onto paper as the paper passes through the copying mechanism. The transfer is achieved through a blend of pressure on the paper and electrostatic attraction of the toner powder to the paper.

8▶ The remaining steps of the copying process finalize the image onto the paper. After the image has been transferred, the next step is to neutralize the electric charge on the paper and separate the paper from the drum surface. After that, the toner is permanently bonded to the paper using heat or a radiant fusing process, both of which ensure that the toner particles are permanently affixed to the paper. Finally, any remaining toner on the drum is cleaned off through a process that typically includes some type of suction to remove the particles. Usually, this toner is carried to a container in the machine for later disposal, though some machines will recycle the toner for use in subsequent copies.

1. The author begins the first paragraph with "One more familiar use of electrochemistry" in order to
- Ⓐ explain that xerography is one of the less familiar uses of electrochemistry
- Ⓑ make it clear that electrochemistry requires photoconductive materials
- Ⓒ show that xerography is the only known use for electrochemistry
- Ⓓ indicate that other less familiar uses have already been discussed

2. Why does the author explain that "A photoconductive material is an insulator in the dark but becomes a conductor when exposed to bright light"?
- Ⓐ It gives an explanation of a property that is necessary for xerography.
- Ⓑ It indicates that bright light is required for insulation to take place.
- Ⓒ It gives one example of a successful xerographic process.
- Ⓓ It explains the role of insulation in xerography.

3. The author mentions "small grains to which dry ink adheres" in order to
- Ⓐ provide information that contradicts the previous statement
- Ⓑ provide another example of conductivity
- Ⓒ provide further detail information about toner
- Ⓓ provide an alternate explanation for the effectiveness of toner

4. Why does the author mention "a laser printer" in the passage?
- Ⓐ It is an alternative to xerography.
- Ⓑ It is a way of duplicating without using electrochemistry.
- Ⓒ It is a second example of xerography.
- Ⓓ It is a less effective type of xerography than is a photocopier.

5. Why does the author include the phrase "except for a push of the "start" button"?
- Ⓐ to explain the one step of the process that Carlson had no control over
- Ⓑ to indicate that it is not necessary to push a button to begin the copying process
- Ⓒ to emphasize that improvements to the copying process reduced the amount of work people had to do
- Ⓓ to show that Carlson had thought of almost every step necessary in the copying process

6. The author mentions that "not many households would be able to dedicate the necessary space" for a copier in order to
- Ⓐ explain that copiers remain exclusively a product for businesses
- Ⓑ emphasize how large the first automatic copiers were
- Ⓒ illustrate the dislike most households had for copiers when they were first introduced
- Ⓓ explain how households have increased in size since 1960

7. Why is "a blend of pressure on the paper and electrostatic attraction of the toner powder" mentioned?
- Ⓐ to summarize the final step of the copying process
- Ⓑ to illustrate how toner is propelled in the development stage
- Ⓒ to explain how the drum is coated with powder
- Ⓓ to explain how the image is transferred onto paper

8. Why does the author discuss suction in paragraph 8?
- Ⓐ to provide an explanation of how the last part of the copying process is achieved
- Ⓑ to illustrate the neutralization process
- Ⓒ to give an example of how toner is recycled
- Ⓓ to explain how the toner adheres to the paper

Paragraph

Demographic Change

1▶ A visitor transported from the early twentieth century to modern times would most likely be amazed by the vast changes in the demographics of the United States over the course of 100 years. The shifts include not only the size of the population and primary residential areas for most Americans, but also notable changes in the age of the population, and even the ratio of men to women. All of these shifts have led to the composition of the United States being startlingly different from what it was just a short century ago.

2▶ The United States had already been gradually moving away from being a country of mainly rural communities to one of more metropolitan centers by the latter part of the 1800s. Nonetheless, in the early part of the twentieth century, over 70 percent of the population still lived in farm communities. The census of 1910 documented approximately 28 percent of U.S. citizens living in urban areas while the rest were dwelling in rural ones. However, by the beginning of the current century, according to the census of 2000, this proportion had reversed itself: 80 percent of the population reported living in urban or suburban areas, leaving only 20 percent residing in rural locales.

3▶ Another significant change is the overall increase in population. According to U.S. census statistics, the population of the United States grew to three times its size over the course of 100 years. In 1900, the official count was 76 million people, while the 2000 census showed a population record of 281 million people, which some people estimate to be much higher, since illegal immigrants tend to avoid being counted in the official census. Additionally, based on census statistics, the decade of the 1990s saw the biggest population explosion—32.7 million people—in any 10-year span of the last century.

4▶ An additional factor that may come as a shock to some is how the United States has aged from 1900 to today. In the beginning of the twentieth century, half of the population was under the age of 23. When compared to data from the 2000 census which shows that half of the population in modern times is over the age of 35, a difference of 12 years, a substantial shift in ages can be seen. Some of this change has been influenced by improvements in health care, and some has been the result of fluctuations in the birthrate over the course of the century. Birthrates were initially lower at the beginning of the century, "booming" immediately after World War II, and tapering off again in the last half of the century. In fact, the "baby boom" generation not only impacted birthrates from the 1940s to the 1960s, it also affected age when measured in five-year increments. In both the beginning and middle of the century, the largest age group of U.S. citizens was under the age of five. In contrast, due to the impact of the baby boom generation, the 2000 census documented that the two largest, five-year age groups were over the age of 30: from 35–39 years of age and 40–44 years of age.

5▶ Another shift that a North American from a century ago would not likely have predicted is the change in the ratio of men to women in the United States. At the beginning of the twentieth century, males outnumbered females in virtually every part of the United States. However, as the proportion of males to females (measured per 100 births) steadily declined in every decade from 1910 until 1980, the predominance of men to women reversed itself; by the turn of the new century, women outnumbered men in all regions of the United States, except the West. Only seven states out of the 50 recorded a higher ratio of men to women, with all of those states being located in the western United States.

6▶ One development that may not be considered such a surprise is the change in racial demographics, especially since the United States has been regarded as a nation of immigrants. Although in the first years of the nation, the vast majority of voluntary settlers to the United States came from Caucasian, or "white" origins, the past century has seen a large influx of other races, including African, Asian, and especially Hispanic (those of Spanish origin or from Spanish-speaking countries) races. As a result, the face of the United States has quite literally been changing. Whereas only two states outside of the southern region of the United States claimed a minority population of more than 10 percent in 1900, 26 states recorded a minority proportion of over 10 percent in 2000. In fact, three states, California, Hawaii, and New Mexico, documented a population comprised of more than 50 percent minorities in the 2000 census.

9. The author mentions "A visitor transported from the early twentieth century to modern times" in order to emphasize
- Ⓐ how travel has changed over the past century
- Ⓑ the popularity of the United States for tourists
- Ⓒ that life has not changed much in the United States since the early twentieth century
- Ⓓ the enormous changes in demographics over the past century

10. The author uses the word "Nonetheless" in paragraph 2 in order to
- Ⓐ indicate that many people still lived in rural areas despite a growing shift to city living
- Ⓑ emphasize how tremendously the rural population was increasing
- Ⓒ point out that there had been a 70 percent rise in rural communities since the late 1800s
- Ⓓ argue that no real change had taken place in rural and urban communities, despite census numbers

11. The author includes the phrase "this proportion had reversed itself" in paragraph 2 in order to
- Ⓐ explain how the population of cities had decreased by the end of the 1900s
- Ⓑ highlight the continually changing residences of Americans
- Ⓒ reinforce the fact that a majority of the population had moved out of rural areas by the late twentieth century
- Ⓓ to emphasize that demographic changes were common in 2000

12. "Illegal immigrants" are mentioned in paragraph 3 as an example of
- Ⓐ a population that is unlikely to grow
- Ⓑ a population that is not always counted on the U.S. census
- Ⓒ a population that accounts for the largest increase of people according to the U.S. census
- Ⓓ a population that usually has no influence on the demographics of the United States

13. Why does the author mention "improvements in health care" in paragraph 4?
- Ⓐ It helps to explain why the birthrate is continuing to increase.
- Ⓑ It is an example of a factor that contributed to variations in the birthrate.
- Ⓒ It helps to explain why the population is younger today.
- Ⓓ It is an example of a factor that contributed to a rise in the age of the majority population.

14. The author mentions the "'baby boom' generation" in paragraph 4 because they
- Ⓐ changed the way the census was conducted in the 1940s
- Ⓑ were responsible for a higher percentage of children younger than five years old
- Ⓒ influenced how the total population of the United States aged in the last half of the twentieth century
- Ⓓ had an impact on how the total population aged in the first half of the twentieth century

15. The word "However" is used in paragraph 5 to introduce the concept that
- Ⓐ more women than men currently live in the United States
- Ⓑ more men than women currently live in the United States
- Ⓒ women outnumber men in the western part of the United States
- Ⓓ women outnumber men in all 50 states

16. The author states "the face of the United States has quite literally been changing" in paragraph 6 to emphasize that
- Ⓐ the demographic changes in the United States are no longer surprising
- Ⓑ minority populations are increasing in the United States
- Ⓒ the descendants of the first U.S. settlers are now the minority race
- Ⓓ minorities make up more than 10 percent of the population in only two states

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